

REMARKS

Claims 3-16, 20-23 and 26-29 were addressed in the office action. Claims 13-16, 20-23 and 26-29 have been withdrawn from consideration as nonelected claims. Claims 3-12 stand rejected.

A. Substance of Telephone Interview

A telephonic interview between Examiner Felton and the undersigned was held on March 27, 2006. No agreement was reached. In satisfaction of the requirement that this response to the subject office action include the substance of the interview (37 C.F.R. §1.133 (b) and MPEP §713.04), the Applicant states the following.

No exhibit was shown and no demonstration was conducted. Claims 3 –13 were discussed, as was prior art references U.S. Patent 3,789,759 to Jones (the Jones reference), U.S. Patent 5,880,399 to Hales et al. (the Hales et al. reference), and U.S. Patent 3,683,811 to Driscoll (the “Driscoll reference”).

No claim amendments were proposed.

The general thrust of the principal arguments of the applicant were that Hales’ teachings are not properly combinable with Jones, and that Hales teaches the opposite of the results that the Applicants discovered and reported in the specification, so that if a prima facie case of obviousness were made, the surprising results would overcome it.

The general thrust of the principal arguments of the Examiner is that Hales shows microballoons in an explosive and that it would be obvious from Hales to use the microballoons in Jones’ detonating cord, and that the Applicant has failed to show unexpected results. The restriction requirement was discussed, but the requirement is maintained.

B. Preliminary Remarks – Reply to Response to Arguments and

In the Response to Arguments portion of the office action, the Examiner asserts that the Applicant has not shown unexpected results and that the claims are deficient for failing to recite an effective amount of microballoons. Both assertions are incorrect.

The Applicant again points out that evidence of the unexpected results is provided in the specification at paragraphs [0052] and [0053], as has been mentioned in previous replies to previous office actions but still overlooked by the Examiner. The unexpected results pertain

to the reduced velocity of the detonation reaction in the detonating cord, which is a different phenomenon from reduced sensitivity in a cast booster, which the Examiner finds in U.S. Patent 5,880,399 to Hales et al. (the Hales et al. reference). In addition, the effects of additives on detonation reactions in cast boosters are not assumed by those of ordinary skill in the art to pertain to detonating cord. These points are supported in the accompanying Rule 132 Declaration. Furthermore, the Hales et al. reference shows that microballoons increase detonation reaction velocity, which is the opposite effect from what is disclosed in the present application. This point is also supported in the accompanying Rule 132 Declaration.

Regarding the recitation of an effective amount of microballoons, the Examiner is reminded that the claims recite the desired effect of microballoons as a functional limitation, and that such functional limitations are perfectly valid and must be considered (see MPEP 2173.05(g)). Thus, contrary to the Examiner's assertion, no embodiments with ineffective amounts of microballoons fall within the scope of the claims. Applicants are not obliged to include in the claim the numerical quantity for the component that provides the stated function. See Andrew Corp. v. Gabriel Electronics, 6 USPQ2d 2010 (Fed. Cir.1988) (overturning Brown Bridge et al. v. Sales Affiliates, 700 F.2d 759, 217 USPQ2d 651 (1st Cir.1983)) ("A claim is not fatally defective for failing to specifically delineate the point at which the change in physical phenomenon occurs." Andrew Corp. at 2014.). Claim 10 does recite an amount, however.

The above points and others in support of the claims are discussed further below and in the accompanying Rule 132 Declaration.

C. Rejection of Claims 3, 5, 8 and 10-12 Under 35 U.S.C. §103

Claims 3, 5, 8 and 10-12 stand rejected under 35 U.S.C. §103 as being obvious over U.S. Patent 3,789,759 to Jones (the Jones reference) in view of U.S. Patent 5,880,399 to Hales et al. (the Hales et al. reference). The Jones reference discloses a detonating cord comprising an explosive core that may include various non-explosive diluents and inerts, but fails to disclose microballoons as a diluent.

Claim 3 and claim 10 both define detonating cords with cores of explosive materials that contain microballoons. Claim 3 states that the explosive material comprises a first pul-

verulent explosive admixed with explosively inert microballoons in an amount which reduces the velocity of detonation. Claim 10 specifies the amount of diluent by percentage.

Explicit evidence of the velocity-reducing effect of the microballoons as recited in claims 3 and 10 is provided in Tables 1 and 2 of paragraphs [0052] and [0053] of the application as filed. For reasons discussed herein, this effect is surprising in view of the prior art.

The Examiner alleges that the velocity-diminishing effect of microballoons is shown in the Hales et al. reference. However, the Examiner only cites disclosures therein at column 2, lines 10-45 addressing the effect of microballoons on impact and initiation sensitivities, run-up distance and critical diameter, all of which relate to cast boosters and none of which are detonation velocities. The difference between these characteristics is noted in part 5(c)(ii) of the accompanying Declaration. More significantly, when the Hales et al. reference addresses detonation velocity at column 4, lines 55-58, it states that microballoons *increase* detonation velocity in the booster charge. *This teaching is the opposite of what the Applicants disclose they found regarding the effect of microballoons on detonation velocity.* See the accompanying Declaration, part 5(c)(iii). Therefore, even if the Hales et al. reference purported to be relevant to detonating cord, the data reported by the Applicants would clearly establish unexpected results that would overcome a prima facie obviousness-type rejection based on the combined disclosures of Hales et al. reference and the Jones reference.

Furthermore, the Applicants respectfully maintain that the Jones reference and the Hales et al. reference cannot properly be combined to support a rejection under 35 U.S.C. 103 because the references disclose devices that comprise different physical forms of explosive materials, and it is known in the art that the form of an explosive material affects its detonation characteristics. See the accompanying Declaration, part 5(c)(i). The differences between the explosive materials in the cited references are evident from their modes of manufacture and use. The Hales et al. reference shows the use of microballoons in a solid cast booster, which is cast from molten or curable material into a relatively short solid block, whereas the Jones reference discloses a detonating cord, for which the explosive material must be disposed in an elongated, flexible configuration to allow the user to dispose it in various configurations, to tie it in knots, etc. (see the Jones reference at, e.g., column 4, lines 19-24). In view of these differences, a detonating cord would be expected to have significantly different prop-

erties and to perform different functions from those of cast boosters, and it would not be obvious that microballoons would function in detonating cord of the Jones reference in the same way they function in the cast booster of the Hales et al. reference. See the accompanying Declaration, part 5(c)(i). Therefore, there seems to be no basis in the art for combining the cited teachings of these references, or for reasonably expecting that the results reported in one of them would also be attained in the other, and the suggestion to do so and expectation that the same results would be obtained appears to be the result of improper hindsight reasoning. Accordingly, claims 3 and 10 and the claims dependent therefrom are patentable over the prior art, and the stated ground of rejection is respectfully traversed.

D. Rejection of Claims 4, 6, and 7 Under 35 U.S.C. §103

Claims 4, 6, and 7, which specify microballoons of a specific size, stand rejected under 35 U.S.C. §103 as being unpatentable over the Jones reference in view of the Hales et al. reference and further in view of U.S. Patent 4,547,234 to Takeuchi et al. The Takeuchi et al. reference is cited for disclosing the phenolic resin microspheres (microballoons) of the claimed size for use in explosive compositions, but not specifically in detonating cord.

The identified claims are all patentable at least because they depend from a base claim that is patentable for reasons set forth above in the preceding section of this response.

Further, the Takeuchi et al. reference discloses that when the specifically sized microballoons are combined with an explosive, they provide a low detonation temperature over a long storage period (see column 3, lines 5-15), thus indicating enhanced sensitivity, whereas the Hales et al. reference states a preference for reducing the sensitivity of a cast booster (see column 2, lines 5-10). Thus, the references teach away from the asserted combination.

E. Rejections of Claim 9 Under 35 U.S.C. §103

Claim 9 stands rejected under 35 U.S.C. §103 as being obvious on various different grounds: (i) over the Jones reference in view of the Hales et al. reference and U.S. Patent 3,367,266 to Griffith ("the Griffith reference") (section 6 of the office action), and (ii) over the Jones reference in view of the Hales et al. reference (section 7 of the office action), and

(iii) over the Jones reference in view of U.S. Patent 3,683,811 to Driscoll (the “Driscoll reference”) and the and further in view of the Griffith reference (section 10 of the office action).

Claim 9 is allowable at least because it depends from a base claim that is allowable for reasons set forth herein.

F. Rejection of Claims 3, 5, 8, and 10-12 Under 35 U.S.C. §103

The captioned claims stand rejected under 35 U.S.C. §103 as being unpatentable over the Jones reference in view of the Driscoll reference. The Jones reference is cited for disclosing detonating cord that may contain a high explosive material and an unspecified diluent, whereas the Driscoll reference is cited for disclosing phenolic microballoons as an inert diluent.

The basis of the rejection, as stated in the “Response to Arguments,” is that the Driscoll reference “clearly teaches the use of microballoons to decrease the burn rate, which makes the composition less sensitive...” and that Driscoll reference discloses results “that are exactly what the Applicant is claiming is unexpected.” In section 11, at the top of page 6 of the office action, the Examiner asserts that “Driscoll teaches that microballoons make the explosive less sensitive” and that it would be obvious “to use the microballoons taught by Driscoll in place of the inert diluents present in Jones.”

The Applicants respectfully submit that the Examiner has misinterpreted the Driscoll reference, and so based the foregoing rejection on faulty grounds. Contrary to the Examiner’s assertion, the Driscoll reference provides no teaching whatever concerning the effect of microballoons on explosive materials, since the microballoons were not included in the explosive material in Driscoll’s device. See the accompanying Declaration, part 6(c)(i). Rather, Driscoll discloses that microballoons slow a burning reaction in the ignition composition, without any indication of how slowing the rate of a burning reaction can be equated to reducing the sensitivity of an explosive material.

The disclosure of the Driscoll reference is not combinable with the disclosure of the Jones reference, because detonating cord (the Jones reference) does not function by virtue of a burning reaction; it detonates. As shown by the evidence submitted by the Applicants with the response dated May 19, 2004 (the pages from Explosives, 2d Ed., by Rudolf Meyer (Ver-

lag Chemie 1981)) and in the accompanying Declaration (part 6(c)(ii)), the art recognizes a clear distinction between burning (deflagration) reactions and detonation reactions. Therefore, those in the art would not assume that all measures effective for slowing of a burning reaction would also slow the rate of a detonation signal, so there is a lack of motivation in the art to apply the teachings disclosed by the Driscoll reference to detonating cord. Furthermore, even if such a motivation were found, and there is no reasonable expectation of success of attaining the effect disclosed by Driscoll in the detonating cord of Jones, due to the fundamental difference between burning reactions and detonation reactions. See the accompanying Declaration, part 6(c)(ii).

Thus, there appears to no support for the Examiner's assertion that Driscoll teaches that microballoons "make the explosive less sensitive". To reliably incorporate the teaching of the Driscoll reference concerning the use of microballoons with the Jones reference, the explosive core of Jones' detonating cord would have to be replaced with a material that would burn rather than detonate. This would amount to a fundamentally different mode of operation. Since an obviousness rejection cannot be based on an asserted combination that requires a change in the mode of operation of one of the references (see MPEP 2143.01), the asserted combination lacks a proper basis in law.

In addition, the art provides no motive for adding the microballoons of the Driscoll reference to the explosive core of the detonating cord of the Jones reference, because the benefit provided by microballoons in the Driscoll reference has no relevance to the Jones reference. The Driscoll reference addresses the electrical continuity characteristics ("reform time") in a bridge wire igniter, but there is no electrical bridge wire in Jones' detonating cord, so reform time is not an issue. Nor is any other motive evident for wanting to reduce the velocity of the reaction in the Jones detonating cord, even if the microballoons disclosed by the Driscoll reference were taught to be effective for this purpose. Therefore, the art fails to provide a motive for making the proposed combination of the microballoons of the Driscoll reference with the detonating cord of the Jones patent.

The foregoing remarks and accompanying Declaration should make it clear that when properly read, the teachings of the Driscoll reference have no relevance to the Jones reference, that the applied references fail to provide any motivation to combine their teachings, and that

even if such a motivation were found, the combination would either require a fundamental change in the mode of operation of one of the references or would lack a reasonable expectation of success. For each of the foregoing reasons, the stated ground of rejection is respectfully traversed.

G. Rejection of Claims 4, 6, and 7 Under 35 U.S.C. 103

Claims 4, 6, and 7 stand rejected under 35 U.S.C. 103 as being unpatentable over the Jones reference in view of the Driscoll reference and further in view of the Takeuchi et al. reference.

The rejected claims are allowable at least because they depend from a base claim that is allowable for reasons set forth above.

Furthermore, the teaching of the Takeuchi et al. reference relates to the use of microballoons in explosives but not in detonating cord, but provides no suggestion or motive for using microballoons in deflagrating ignition materials (the Driscoll reference) or for expecting that microballoons would function the same way in both kinds of materials. As previously mentioned and as supported in the accompanying Declaration (see part 6(c)(ii)), materials that burn operate under a fundamentally different mode of operation from those that explode. Thus, there would be no motive to apply the teachings of microballoons from Takeuchi et al. to the ignition composition of Driscoll. Accordingly, the stated ground of rejection is respectfully traversed.

H. Request for Reconsideration of Restriction Requirement

In the above-mentioned telephone conference, the restriction requirement was discussed. The latest office action premised the restriction between I and III on the basis that the process claim can be used to make a detonating cord with a granular core while claim 3 was limited to a solid core.


In the telephone conference, the undersigned pointed out that claim 3 was previously amended to delete the word "solid" and that it calls for a pulverulent core material. The Examiner asserted that restriction was proper because the claimed cord could be made in a process in which the sheath is sprayed onto the core. The undersigned pointed out that spraying on

the sheath would still result in a sheath that encases the explosive core (claim 3) and would be a process in which the core material is enclosed within the sheath (claim 21). The method claim is not limited to any particular method for enclosing the core material in the sheath, and the product claim is not limited to any method for its manufacture. It is therefore evident that the Examiner has failed to show that the product of species I could be made by a process that is materially different from the method of species III. Accordingly, reconsideration of the restriction requirement and rejoinder of the claims of species III is respectfully requested. In addition, since the product and method of making are not patentably distinct, the method of use (invention II; claims 13-16, 20 and 29) must be joined as well. See 37 CFR 1.141(b); MPEP 806.05(i).

Each of the stated grounds of rejection have been addressed or traversed. Reexamination and reconsideration of the pending claims, and reinstatement of the claims withdrawn from consideration, are respectfully requested.

Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANTS: Thomas L. Barkley et al : GROUP ART UNIT: 3641
SERIAL NO: 09/863,795 :
FILING DATE: May 23, 2001 : EXAMINER: Aileen B. Felton
TITLE: DETONATING CORD AND METHODS OF :
MAKING AND USING THE SAME :

DECLARATION TRAVERSING REJECTION, SUBMITTED
UNDER RULE 1.132

I, Mark Woodall, hereby declare as follows:

1. I am one of the inventors named in the subject patent application.

2 (a). I have been an employee of The Ensign-Bickford Company and then Dyno Nobel, Inc. for sixteen years, working in research and development and plant management in the field of explosives and other reactive products for use in the oil and gas industry, the mining industry and aerospace and defense industry. My background in these fields is summarized in the resume attached hereto.

(b). I named as an inventor in United States Patent 6,694,886, entitled "Rigid Reactive Cord And Methods Of Use And Manufacture," granted February 24, 2004.

3. I have reviewed the claims 3-12 being submitted herewith in the captioned application, and the office action dated November 2, 2005 and prior art docu-

ments U.S. Patent 3,789,759 to Jones, U.S. Patent 5,880,399 to Hales et al. and U.S. Patent 3,683,811 to Driscoll referred to therein.

4. Claims 3-12 all pertain to detonating cord that has microballoons in the explosive material in the core of the cord. The development work on this invention unexpectedly revealed that the microballoons reduce the velocity of the transmission of the detonation reaction along the length of the detonating cord.

5(a). Beginning on page 3 of the November 2, 2005 office action, claims 3, 5, 8 and 10-12 have been rejected on the basis that they are obvious in view of the disclosures of Jones and Hales et al., the Examiner stating that it would be obvious to use the microballoons mentioned by Hales et al. in the detonating cord shown by Jones to reduce the reaction velocity in the detonating cord.

(b)(i). Jones discloses a detonating cord comprising an explosive core that may include various non-explosive diluents and inerts, but does not disclose microballoons in detonating cord.

(ii). Hales et al. show the use of microballoons in a cast booster. Hales et al. discuss the effect of microballoons on impact sensitivity, critical diameter, and other characteristics of the boosters therein.

(c). To one of ordinary skill in the art, the Examiner's basis for finding the claims obvious in view of Jones and Hales et al. is incorrect for at least the following reasons:

(i) A cast booster is a significantly different kind of device from detonating cord (Jones). One way that these device differ is in their physical configurations. Typically,

a cast booster is significantly larger in diameter than a detonating cord and is monolithic and inflexible, whereas a detonating chord has a relatively smaller diameter, contains granulated explosive material and is flexible. Since it is known in the art that the physical configuration of a mass of explosive material affects its performance characteristics, the performance characteristics of a cast booster are not taken as being equivalent to those of detonating cord. Therefore, whatever effect that microballoons have in a cast booster as taught by Hales et al. would not be expected by one of ordinary skill in the art to be replicated in a detonating cord.

(ii) The Examiner refers to the report by Hales et al. of the effect of microballoons on the detonation and impact sensitivity of the explosive as being the same as the effect on detonation signal velocity. However, sensitivity is not the same as velocity; they are separate and distinct characteristics of an explosive. Therefore, Hales et al.'s teachings that microballoons decrease the sensitivity of a booster charge do not pertain to detonation velocity.

(iii) In regard to velocity of detonation, Hales et al. teach the opposite of what the Examiner asserts. Hale et al. disclose that microballoons *increase* the detonation velocity in the boosters (see column 4, lines 54-60). *This is the opposite of what we found happened when microballoons are added to detonating cord.* As we disclose in our application at page 15-16, paragraphs 52-54, adding microballoons *reduces* the velocity of a detonation signal in the detonating cord.

6. Beginning on page 5 of the November 2, 2005 office action, claims 3, 5, 8, and 10-12 are also rejected on the basis of the Jones patent viewed with U.S. Patent 3,683,811 to Driscoll, the Examiner stating that it would be obvious to use the microballoons mentioned by Driscoll in Jones' detonating cord.

(a). Driscoll discloses an electrical initiator device in which a bridgewire 13 receives an electric pulse that vaporizes the bridgewire and initiates an ignition charge (23), which burns and then ignites a delay fuse (22). The delay fuse initiates a primer composition (18), which in turn initiates the output charge (16). Driscoll teaches the use of microballoons in the ignition composition. Driscoll states that after the bridge-wire vaporizes, the ignition composition generates conductive gases and/or forms conductive slag that allows for the flow of electricity between the input leads, thus reforming the circuit previously provided by the bridgewire (see column 2, lines 8 – 48). Driscoll calls the period of time between vaporization of the bridgewire and when the circuit is reformed the “circuit reform time.”

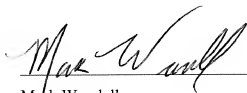
(b). Driscoll discloses that adding a diluent to the ignition composition increases the circuit reform time by decreasing the burning rate of the ignition composition (column 3, lines 35-45). Driscoll mentions microballoons as one possible diluent for this purpose (column 7, lines 43-65). Sample ignition compositions are disclosed in the Examples (see Table 2). Driscoll’s ignition composition is not an explosive material and there is no discussion of the effect of microballoons in an explosive material.

(c)(i). The Examiner’s assertion that Driscoll teaches that microballoons “make the explosive less sensitive” is mistaken, because Driscoll provides no teaching about the effect of microballoons on an explosive material. Furthermore, the references provide no motive for reducing the sensitivity of the Jones detonating cord.

(ii). Further, one of ordinary skill in the art would not conclude that because Driscoll teaches that the burn rate of an ignition composition is slowed by adding microballoons that microballoons would reduce the velocity of a detonation signal in a detonating cord. As shown by the attached pages from Explosives, 2d Ed., by Rudolf

Meyer (Verlag Chemie 1981)) the art recognizes a clear distinction between burning (deflagration) reactions and detonation reactions as being different modes of operation. Accordingly, those of ordinary skill in the art do not assume that measures effective for slowing of a burning reaction would also slow the rate of a detonation signal.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.


Mark Woodall

4/25/06
Date: March, 2006

Mark E. Woodall

Objective	Patent Application	
Experience	1989–Present	Dyno Nobel Inc (Formerly The Ensign Bickford Co.) Graham Kentucky Team Leader(Plant Superintendent) Molecular Plant - Graham, Ky. <ul style="list-style-type: none">• 2003–Present.• Management of Pentaerythritol Tetranitrate (PETN) explosive manufacturing plant.• Research and Development Manager Detonating Cord Plant. Team Leader(Plant Superintendent) Detonating Cord Plant-Graham K <ul style="list-style-type: none">• .1999-2003• Managed 45 Production personnel• Research and Development Manager Detonating Cord Plant Senior Research Engineer –Ensign Bickford Aerospace Division – Graham Ky. <ul style="list-style-type: none">• 1995 -1999• USA Government “Secret” project manager – plastic explosive reactive armor technology development• Management level research position. Product Development Engineer – Ensign Bickford Detonating Cord Plant - Graham Ky. <ul style="list-style-type: none">• 1989 - 1995• Product Development technician promoted 5 times to Engineer level.• Under tutorage of Stan Kelly, holder of 4 Detonating cord patents and 41 years experience in detonating cord Research and Development.
Education	1981-1986	Western Kentucky University Bowling Green, Ky <ul style="list-style-type: none">• B.S. Double Major Chemistry and Biology
Extracurricular	Member of “MENSA” High IQ society	
Previous Patents	Primary Inventor on USA patent #6694886 “ Rigid Reactive Cord...”	